



GOSHEN COLLEGE
MATHEMATICS DEPARTMENT
MATH 205 DISCRETE MATHEMATICS - FALL 2023-24

Motivation	Scientists, economists, and others use mathematics to create models and perform calculations to gain a better understanding of the world. Mathematicians use abstraction and deductive reasoning to analyze quantity, shape, and structure. Math 212 Calculus II (continuous structures) and this course (discrete structures) help you transition from a user of mathematics to a creator of mathematics.
Catalog Description	An introduction to mathematical thinking and reasoning. Topics include number systems and arithmetic, logic and Boolean algebra, functions and relations, set theory, algorithms, combinatorics and probability, matrices, and elementary graph theory. An emphasis is placed on problem solving and proof techniques. Recommended background: four years of high school mathematics, including some calculus or Math 211. Earns 3 credits.
Learning Objectives	<p>The student will</p> <ol style="list-style-type: none">1. Use truth tables, symbolic logic, and proof schema to analyze and write definitions, conjectures, and proofs (logical thinking);2. Describe informal representations, state formal definitions, and provide examples and nonexamples of basic set, matrix, relation, function, and graph concepts, and use these concepts to solve problems (relational thinking);3. Use and create recursive definitions to solve problems, and use mathematical induction to prove theorems (recursive thinking);4. Use addition and multiplication principles to count discrete structures and algorithmic steps (quantitative thinking);5. Create, code, execute, and analyze algorithms (algorithmic thinking);6. Learn mathematics by reading, listening, exploring, and conversing in an effective manner (learning modes);7. Explain and critique mathematical reasoning through speaking and writing in a precise and articulate manner in both informal and formal settings (communication);8. Exhibit curiosity, playfulness, creativity, confidence, perseverance, interest in multiple perspectives, and a collaborative spirit (dispositions).
Instructor	David Housman, SC 117, dhousman@goshen.edu, 574-535-7405. Hours when he is available in his office are posted on his office door and on Moodle.
Class	MWF 8:00-8:50 a.m. in SC 203. Attendance and participation are expected. Class activities will complement, not substitute, for the reading, problem solving, and concept discussing students engage in outside of class.
Textbook	Al Doerr and Ken Levasseur, <i>Applied Discrete Structures, Part I Fundamentals, May 2022, Version 3-9</i> . This is a free pdf, but an optional print version is also available.
Software	CoCalc and SageMath will be used for computation.
Notebook	A three-ring binder with loose-leaf lined and graph paper is recommended so that you can keep a written record of problem-solving attempts, questions, math discoveries, and skill assessments.
Activities	The study of mathematics is not a spectator sport! Reading, listening, solving problems, writing explanations, reflecting upon ideas, and receiving feedback are essential to learning mathematics. Read with paper and pencil in hand and take an anticipatory approach: try to obtain solutions,

explanations, and proofs before reading what the author provides. If you do not understand something, write a question that is as specific as possible. Describe from memory the key concepts and techniques.

An average student can obtain an average grade with an average of nine hours each week devoted to this course—adjust if you are not average or desire a grade that is not average.

Moodle will announce the preparation for a class and the graded assignment to be completed before the next class. The preparation will typically involve reading a portion of the textbook and attempting some exercises that have full or partial answers in the textbook. During class, students and the instructor will summarize the important concepts and techniques, ask and answer questions about the material covered, and solve additional problems. All students will verify the correctness of solutions, ask questions, and provide personal insights. Students should bring to class paper and writing instruments, an iPad, or some other device as an aid to solving problems and for recording concept discoveries, questions, and assessments of your learning, problem solving, and collaboration performances.

Grading

Course grades will be based on assignments (35%), three midterm exams (45%), and a comprehensive final exam (20%). If helpful, the final exam grade will replace the lowest midterm exam score. The course grade will be translated into letter grades in the following manner.

Minimum Percentage	93	90	87	83	80	77	73	70	67	60	0
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F

Assignments

Achieve and exhibit understanding by completing the assigned exercises. You are encouraged to collaborate and seek assistance when having difficulties; however, you should eventually write your own solutions. You will have achieved the expected level of understanding when you are able to obtain your own solutions, independently reproduce solutions developed in collaboration or with assistance, and/or explain a solution to others. Assignments will be collected at the beginning of almost every class. Rewrites and late submissions will be assessed a 30% penalty and typically be due the second class after the original due date.

Exams

Exhibit your ability to solve problems and describe mathematical concepts without assistance or collaboration. There will be both closed-book in-class and open-book take-home portions.

Activities Extra Credit

Receive extra credit toward your assignments grade by doing one or more of the following: (1) find content errors in the textbook or posted course materials and describe the error in writing; (2) attend a quantitative presentation (e.g., [Science Speakers](#)) or participate in a quantitatively based activity and describe in writing some interesting mathematical aspect of the presentation or activity; or (3) participate in a [Career Services](#) event and describe your most important discovery. For any of these activities, the description should be at least one substantive paragraph and be submitted to the instructor on paper or via email. Up to 10 points will be earned towards your assignments grade for each report and a maximum of 70 points can be earned in total.

Tentative Schedule

Topics	Chapters	Exam Date
Set Theory and Combinatorics	1 – 2	Wednesday, September 20
Logic and Proof	3 – 4	Wednesday, October 18
Matrices, Relations, and Functions	5 – 7	Monday, November 13
Everything including Recursion, Graphs, and Trees	1 – 10	Wednesday, December 6, 8:00-10:00am

Accessibility Accommodations	Goshen College is committed to providing all students equitable access to programs and facilities. Students who need accommodations based on disability should contact the Academic Success Center (ASC). Students must register with the ASC before faculty are required to provide reasonable accommodations. For more information or to register, please contact the Director of Academic Success, Michelle Blank, Good Library 112, mblank@goshen.edu or 574-535-7526. To ensure that learning needs are met, contact the ASC the first week of classes. More information at: https://www.goshen.edu/campuslife/asc/disability-services/ .
Study Sessions, Extra Credit, and Tutoring	A Student Teaching Assistant (STA) will run study sessions at scheduled times. This is a good time to study and collaborate with other students with the STA available to answer questions and provide guidance. The schedule will be announced shortly after the beginning of the semester. You will receive 10 extra credit points towards your assignments grade for each study session attended up to a maximum of 70 points. The Academic Success Center provides individual tutoring by appointment at tutorcal.goshen.edu .
Collaboration and Academic Integrity	<p>You are encouraged to use all available resources to learn the concepts and techniques discussed in this course. Conversations with other students and the instructor can be an effective learning method. Reading other books and web pages can be another effective learning method. However, copying someone else's work subverts the learning process.</p> <p>For assignments, you may look at and discuss another person's written work, but you may not directly copy that work when writing you answers. You may collaborate with others, but any written work developed during such a collaboration should be destroyed before writing your own solutions. You should give written acknowledgement to people with whom you have had discussions and to any written materials (other than the texts) that were helpful. When completion by a group of students is permitted, the above restrictions do not apply to persons within the group.</p> <p>For exams, you may not use any resources unless a specific exception is stated by the instructor. Failure to observe the above rules will result in a zero on the assignment or exam. Any violation of academic integrity will be reported to the Associate Academic Dean.</p> <p>Observation of the above rules will help you learn the material well and give you the satisfaction of knowing that you have earned your grade.</p>
Due Date Policy	Assignments and exams can only be excused, rescheduled, or made up if (1) there is a serious medical problem, a death in the immediate family, or an irreconcilable conflict with another official Goshen College activity; (2) there is written documentation signed by proper authorities; and (3) the instructor is notified prior to the due date or as soon as possible afterwards.
Course Materials are for Private Use	Course materials (videos, assignments, exams, problem sets, etc) are for use in this course only. You may not upload them to external sites, share with any person outside this course, or post for public commentary without written permission from the professor. Sharing recordings outside of the class could lead to a copyright or FERPA violation. Goshen College prohibits any student from duplicating, downloading, or distributing class recordings with anyone outside of this class, for any reason.
Student Life Resources	<p>Goshen College is committed to providing a safe, supportive, and equitable learning environment. If you encounter circumstances that impact your learning or personal safety, please contact someone from Student Services (studentservices@goshen.edu or 574.535.7474).</p> <ul style="list-style-type: none"> • Any student who has difficulty accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students Gilberto Pérez Jr. (gperez@goshen.edu or 574.535.7434) for support. • Adriana Ortiz, Director of Hispanic Student Recruitment and Family Engagement, is available to help commuter students (aortiz@goshen.edu or 574.535.7291).

- Resident Directors Kevin Schultz (kevints@goshen.edu or 574.535.7286) and Jordan Blank (jblank@goshen.edu or 574.535.7296) are available to assist residential students.
- If you experience safety issues on campus, please contact Chad Coleman, Director of Campus Safety (chadc@goshen.edu or 574.535.7292).

Goshen College does not condone and will not tolerate inappropriate conduct toward any individual based on the individual's sex, sexual orientation, national origin, race, ethnicity, documentation status or gender identity. Issues related to [gender](#) and [racial](#) discrimination or harassment can be reported online. You may also contact Dean of Students Gilberto Pérez Jr. (gperez@goshen.edu or 574.535.7434) or Deputy Title IX Coordinator Liz Andes (landes@goshen.edu or 574.535.7484).